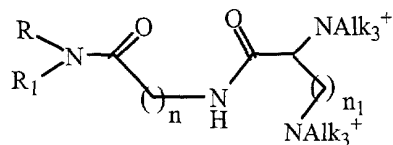


## Claims

We claim:

Claim 1. A cationic lipid having the formula II:

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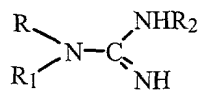


10

wherein, n is 1, 2 or 3 carbon atoms; n<sub>1</sub> is 2, 3, 4 or 5 carbon atoms; R and R<sub>1</sub> independently represent C12-C22 alkyl chain which are saturated or unsaturated, wherein the unsaturation is represented by 1-4 double bonds; and Alk represents methyl, hydroxyalkyl or a combination thereof.

Claim 2. A cationic lipid having the formula III:

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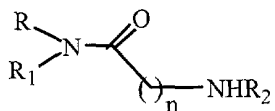


wherein, R and R<sub>1</sub> independently represent C12-C22 alkyl chain which are saturated or unsaturated, wherein the unsaturation is represented by 1-4 double bonds; and R<sub>2</sub> is H, PEG, acyl or alkyl.

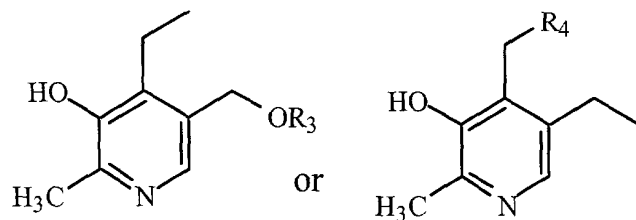
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Claim 3. A cationic lipid having the formula IV:

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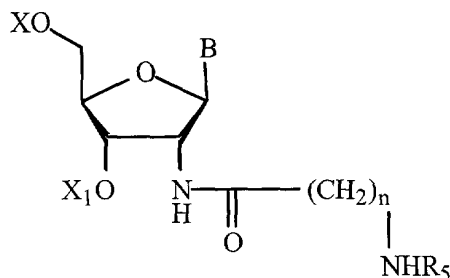


wherein, n is 1-6 carbon atoms; R and R<sub>1</sub> independently represent C12-C22 alkyl chain which are saturated or unsaturated, wherein the unsaturation is represented by 1-4 double bonds; and R<sub>2</sub> is H, PEG, carboxamidine, alkyl, acyl, aryl, substituted carboxamidine,



wherein  $R_3$  is H, or  $\text{PO}_3\text{H}_2$  and  $R_4$  is OH,  $\text{NH}_2$  or  $=\text{O}$ .

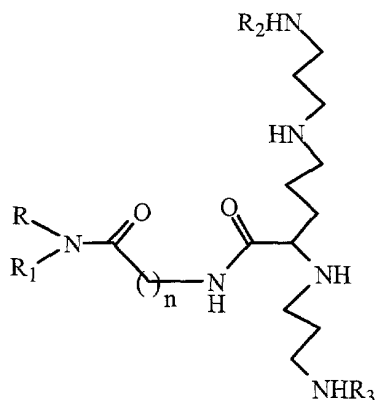
5 Claim 4. A cationic lipid having the formula V:



wherein,  $n$  is 1-6 carbon atoms;  $X$  and  $X_1$  independently represent C12-C22 alkyl chain which are saturated or unsaturated, wherein the unsaturation is represented by 1-4 double bonds;  $B$  is a nucleic acid base or H; and  $R_5$  is H, PEG, or carboxamidine.

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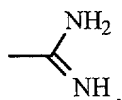
Claim 5. A cationic lipid having the formula VI:



wherein,  $n$  is 1, 2 or 3 carbon atoms;

$R$  and  $R_1$  independently represent C12-C22 alkyl chain which are saturated or unsaturated, wherein the unsaturation is represented by 1-4 double bonds; and  $R_2$  and  $R_3$  is independently H, polyethylene glycol (PEG) or

15



Claim 6. A cationic lipid having the formula VII:

5  $R_6$ - $L_1$ -Cholesterol

wherein,  $R_6$  is selected from the group consisting of arginyl methyl ester, arginyl amide, homoarginyl methyl ester, homoarginyl amide, ornithine methyl ester, ornithine amide, lysyl methyl ester, lysyl amide, triethylenetetramine (TREN), *N,N'*-di-carboxamidine TREN, *N*-benzyl histidyl methyl ester, pyridoxyl and aminopropylimidazole; and

10  $L_1$  is a linker represented by  $R_7PO_2$ , wherein  $R_7$  is H,  $CH_3$ , or  $CH_2CH_3$ .

Claim 7. A cationic lipid having the formula VIII:

15  $R_8$ - $L_2$ -Cholesterol

wherein,  $R_8$  is selected from the group consisting of arginyl, *N*-Boc arginyl, homoarginyl, *N*-Boc homoarginyl, ornithine, *N*-Boc ornithine, *N*-benzyl histidyl, lysyl, *N*-Boc lysyl, *N*-methyl arginyl, *N*-methyl guanidine, guanidine and pyridoxyl; and  $L_2$  is a linker represented by NH, glycine, *N*-butyldiamine or

20 guanidine.

Claim 8. The cationic lipid of claim 1, wherein said cationic lipid is *N'*-palmityl-*N'*-oleyl- $\alpha$ ,  $\gamma$ -bis-trimethylammoniumbutyryl-glycinamide.

Claim 9. The cationic lipid of claim 2, wherein said cationic lipid is *N'*-palmityl-*N'*-oleyl-*N*-carboxamidine-glycinamide.

Claim 10. The cationic lipid of claim 2, wherein said cationic lipid is *N'*-palmityl-*N'*-oleyl-guanidine.

Claim 11. The cationic lipid of claim 7, wherein said cationic lipid is Boc arginine-cholesterylamine.

Claim 12. The cationic lipid of claim 6, wherein said cationic lipid is Cholesterol-Lysine-methyl ester-methylphosphonoamidate.

Claim 13. The cationic lipid of claim 6, wherein said cationic lipid is Cholesterol-methyl ester-homoarginine-methylphosphonoamidate.

5 Claim 14. The cationic lipid of claim 6, wherein said cationic lipid is Cholesterol-Lysine-amide-methylphosphonoamidate.

Claim 15. The cationic lipid of claim 6, wherein said cationic lipid is Cholesterol-TREN-methylphosphonoamidate.

Claim 16. The cationic lipid of claim 6, wherein said cationic lipid is Cholesterol-TREN-bis-guanidinium methylphosphonoamidate.

Claim 17. The cationic lipid of claim 6, wherein said cationic lipid is Cholesterol-histidine-methylphosphonoamidate.

Claim 18. The cationic lipid of claim 6, wherein said cationic lipid is Cholesterol-aminopropylimidazole-methylphosphonoamidate.

15 Claim 19. The cationic lipid of claim 3, wherein said cationic lipid is *N'*-palmityl-*N'*-oleyl-beta-alanine amide.

Claim 20. The cationic lipid of claim 3, wherein said cationic lipid is *N'*-palmityl-*N'*-oleyl-*N*-carboxamidine beta-alanine amide.

Claim 21. The cationic lipid of claim 3, wherein said cationic lipid is *N*(*N'*-  
20 palmityl-*N'*-oleyl-amidopropyl)pyridoxamine.

Claim 22. The cationic lipid of claim 7, wherein said cationic lipid is *N*-cholesteryl-pyridoxamine.

Claim 23. The cationic lipid of claim 7, wherein said cationic lipid is 3',5'-Di-palmitoyl-2'-deoxy-2'-(N-carboxamidine-beta-alanineamido) uridine.

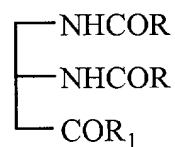
Claim 24. The cationic lipid of any of claims 1-7, wherein said cationic lipid ion-pairs to a negatively charged polymer selected from the group consisting of RNA, DNA,  
5 and protein.

Claim 25. The cationic lipid of claim 24, wherein said RNA and said DNA comprise one or more modifications.

Claim 26. The cationic lipid of claim 24, wherein said RNA is an enzymatic RNA.

Claim 27. The cationic lipid of claim 24, wherein said dNA is an enzymatic DNA.

10 Claim 28. A cationic lipid having the formula IX:



wherein R is independently C12-C22 alkyl chain which are saturated or unsaturated, wherein the unsaturation is represented by 1-4 double bonds; and R<sub>1</sub> is selected from the group consisting of TREN, N,N'-di-carboxamidine TREN,  
15 lysyl, arginyl, ornithyl, homoarginyl, histidyl, aminopropylimidazole, and spermine carboxylic acid.

Claim 29. The cationic lipid of claim 28, wherein said cationic lipid is N<sup>2</sup>,N<sup>3</sup>-dioleoyl-(N,N'-diguanidinoethyl-aminoethane)-2,3-diaminopropionic acid.

20 Claim 30. The cationic lipid of claim 4, wherein said cationic lipid is 3',5'-Di-palmitoyl-2'-deoxy-2'-(beta-alanineamido) uridine.

- Claim 31. The cationic lipid of claim 4, wherein said cationic lipid is 3',5'-Di-palmitoyl-2'-deoxy-2'(*N*-carboxamidine-beta-alanineamido) uridine.
- Claim 32. The cationic lipid of any of claims 1-7, wherein said cationic lipid is linked to polyethylene glycol (PEG).
- 5 Claim 33. The cationic lipid of claim 32, wherein said PEG is between about 2000-5000 daltons inclusive.